Geos1001: Earth, Environment and Society

Lecture 1:

Three elements of geography:

- Evolution of the Planet
- Physical Environment
- Human Environment

Our dynamic Planet:

- Geology
    - Geologist look at the rocks to "see" into the past and helps us to understand the process of governing the Earth systems
        - The evolution of planets
        - Life-support mechanisms
        - Tectonics
        - Climate
        - Resources and sustainability

- 300 billion stars in the Milky Way and 100 billion observable galaxies
- We have actually really not explored much of our oceans
    - Oceans have seamounts!!

Feb 2017: 7 Earth-sized planets in the TRAPPIST-1 System

Goldilocks obit = potentially inhabitable, the mass in the given star is far less and exerts strong red sun rays

Origin of the elements: nuclear fusion

- Nuclear-synthesis occurs within stars through nuclear fusion where atoms are forced together

Formation of the solar system:

- Terrestrial (rocky planets) and GAS giants
- Jupiter has huge eruptions causing tides

Moon

- Cooling and chemical segregation- density is essential
- Density – mass per unit and gives the ultimate buoyancy and then gravity
- Also heat sources
    - Remnant kinetic energy from accretion
    - Radiogenic heat
- Further heat transfers modes into such of conductive, convection and radioactive

DID water come from icy comets?

Environmental change and socioecological systems

- Human well-being is inextricably linked to Earth system functioning
- The relationship between Human population grow and the emergence of extinctions have a direct relationship
    - Deforestation in Brazil
- The physical, biogeochemical ad ecological systems all interlink in the Earth's unique system and functionality
- How much change is too much change?
    - i.e **Resilience** The capacity to absorb disturbance and retain the same structure, function and feedbacks
    - Socio-ecological resilience such as complex interdependencies, rapid development and capacity for innovation
    - FOR EXAMPLE: there is a regime change such as an abrupt change or a gradual change
- "Tipping point"
- Independence of planetary boundaries
    - Will crossing one boundary impact the position of another??
        - Ocean acidification and biosphere integrity or Land system change and freshwater use

- Interactions between biophysical processes requires further understanding as currently contribute to considerable uncertainty in defining boundaries
- Importance of spatial trend and scale
- Exposure and location is also imperative

WEEK 1: READINGS

Barrie Pittock – From academic science to political hot potato: climatic change, risk policy and policy relevance

Main ideas:

- Climate change is happening – and therefore it is a reason to act (otherwise it will be too late), empirical scientific evidence doesn't need to be proved
- Conflict between individual v group scientists
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- The notion of Climatic Change was only founded by academic realms in 1975, but now places a hot political topic that indeed blurs the boundary between policy relevant and policy prescriptive.

Timeline:

- The idea that human activities might affect climate was evident by **John Tyndall's** demonstration in 1859 that methane and carbon dioxide control the Earth's surface air temperature by absorbing infra-red or heat radiation.
- **Svante Arrhenius** then in 1896, highlight that the increasing CO2 could perhaps lead to a warming Earth climate
- **GS Callendar** then further developed this theory in 1938… but it was in 1950 that **Charles Keeling** of the Scripps that "Human beings …within a few centuries we are returning to the atmosphere and oceans the concentrated organic carbon-stored in sedimentary rocks over hundreds of millions of years.
- **1970s** saw the evidence of cooling since the 1950s in the northern hemisphere led to some concern that prolonged cooling trend could lead to another glaciation through the snow albedo feedback (Federal Council for Science and Technology 1974)
    - The cooling was indeed just temporary and mostly caused by likely increases in tropospheric aerosols from the post WWII Industrialisation with sulphur-rich fossil fuels
- First legitimate concerns of rising global temperatures were endorsed in the World Meteorological Organisation (WMO)'s First World Climate Conference in 1979 expressing that the increase in CO2 could lead to gradual warming of the lower atmosphere. Further, the conference highlighted that the world needed to **"foresee and prevent potential man-made changes in climate that might be adverse to the well-being of humanity"**
- 1980s then saw a clear cooling trend ceasing, and rather the opening of continued increases in greenhouse concentrations and the realisation that the effective lifetime of greater cumulative warming effect meant that by the early 1980s there was a growing scientific interest of GLOBAL WARMING!!
- 1985 the WOM and the United Nations Environment Program agreed to have a statement to raise first collective scientific warning
- 1986, the Scientific Committee on Problems of the Environment (SCOPE), a committee of the International Council of Scientific Unions issued a report on *The Greenhouse Effect, Climate Change and Ecosystems* – reporting on the possible impacts of agriculture, forests and ecosystems
    - By 1988, this concern turned into a demand for action to reduce Carbon Dioxide emissions, adopted by over 300 scientists at a United Nations sponsored 'Conference on the Changing Atmosphere' in Toronto in 1988.

- IPCC was established in 1988 (Intergovernmental Panel on Climate Change) – founded by the United Nations and WMO
    - Ultimate objective of the UNFCCC is to "stabilize greenhouse gas concentrations in the atmosphere at a level that would prevent dangerous anthropogenic [i.e., human-induced] interference with the climate system".
    - IPCC reports cover "the scientific, technical and socio-economic information relevant to understanding the scientific basis of risk of human-induced climate change, its potential impacts and options for adaptation and mitigation
- IPCC argued that uncertainty is a reason not to act, whereas in a responsible risk management framework it may well be a reason to act
    - The lack of risk management insight mitigates against highlighting the experience of extremes in the present changed climate simply because attribution is uncertain

Australia:

- Australia rests on numerous recent series of widespread and highly damaging wildfires in the last decade, record heatwaves, widespread droughts and coastal impacts either experienced or anticipated under more stringent planning rules and higher insurances costs – thus amounting into hundreds of lives and billions of dollar annually
- **It appears as if research organisations merely employ scientists that are thereby funded by governments or other bodies loathe published policy-relevant work that might construe and undermine to be policy prescriptive.**
- Further, those individual scientists can be torn between a perceived public duty to make the policy relevance of their findings known, and the need to avoid, as scientist making value judgements as to the most appropriate policy.

In conclusion – a broader acceptance of a risk management approach by scientists is needed

- The reality does not operate on certainties, but instead lives with uncertainties and makes decisions based on conscious and unconscious assessments of probabilities
- *Climatic Change* as a journal has shifted and adjusted to the times, with the increasing emphasis on policy related research – to discuss the physical science, potential impacts, economics and policy implications that it faces

Policy-relevant conclusion is that there is a high risk that present damages due to extremes events in Australia are in fact heightened by climate change trends. The logical policy implication, if that ongoing risk is judged to be unacceptable, is that the situation needs to be remedied by both adaptation to a new regime of extreme events and reduction in greenhouse gas emissions that are the root of the problem.